Next Generation Instrumentation Bus

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NexGenBus

The Instrumentation Bus Into The Next Millenium

Requirement

Current programs such as F/A-18 E/F, F-22, and JSF all have composite data rate requirements that exceed the capacity of any single instrumentation system bus. These programs have accommodated their data requirements with a clumsy arrangement of multiplexers. The increased fusion of data from numerous sources (i.e. analog measurements, digital buses, digital radar data, and digitized video) to support testing and simulation will simply overwhelm this approach. The instrumentation community needs a single standard instrumentation bus with data rates significantly greater than the current standard. To comply with Acquisition Reform and the emphasis on COTS hardware, the instrumentation community needs to adopt a high speed bus standard. This would provide the instrumentation vendors a clear commercial interface standard that can be used to modify/develop COTS hardware.

Program

NexGenBus is an OSD sponsored program with tri-service participation that is leading the way to network based test instrumentation systems. The goal is to establish a commercial communications bus as a standard for the test instrumentation system of the future.

Payoff

This will enable the instrumentation community to leverage off developments and purchasing power in other industrial areas – like the consumer PC market. Many benefits can be derived from sharing a common bus. The most obvious is a lower cost of ownership for the bus itself (interface hardware, support equipment, and software). Additional benefits include the portability of the data and peripherals (hard drives, displays, etc) that may be adapted for use in a test article.

Strategy

This project will be executed in 4 phases across 3 years.

Phase one of this project will be the detailed definition of the requirements for the next generation instrumentation bus. This will begin with a comprehensive analysis of the overall data acquisition network requirements. Once the overall data acquisition network requirements are defined, the required capabilities of the instrumentation bus can be developed.

Phase two will be a technical review of the existing bus standards to determine if any meet the bus requirements developed in phase one. This analysis shall include:

1) Compatibility of data protocols with the requirements.
2) Compatibility of the physical layer with the environment (EMI, vibration, temperature, etc.)
3) Verification that the standard has sufficient detail to ensure compatibility

Phase three will be a technology demonstration to verify that the bus or busses selected in phase 2 can perform in the required environment. This technology demonstration will consist of laboratory tests with simulated aircraft environments.

If the outcome of phase two or three reveals that no existing standard will meet the requirements, this project will be terminated.

Phase four will provide the engineering support to write the physical standard based on the selected bus

Participation Offered

CBDNet submission number 164594 was posted 3 Feb 98 with information regarding vendor input to this project.

Approved For Public Release; Distribution is Unlimited

Project Status

The first half of the NexGenBus schedule is shown below. The first three tasks have been accomplished. Each of these tasks resulted in a living document. The documents will be updated as new information or insight warrants.

Data System Definition With the goal of defining the evaluation criteria for instrumentation busses, the system features of a 'Future Data Acquisition System' were identified. One of the major requirements was the ability to bridge to units on other busses thus allowing existing instrumentation inventories to be used. Other features included simultaneous sampling, various data inputs and outputs, smart transducers, environmental, network topology, and security.

Bus Requirements The data system definition was used as a framework. For each data system element, the associated bus characteristic was determined. As insights and information are gained, this list will be updated.

Compile Bus List The world was searched for non-proprietary communications busses. Leading the charge were generic open searches on the web using several of the more prominent search engines. This was closely followed by thorough searches of standards organizations (IEEE, ANSI, etc.). Trade journals and technical magazines provided a lot of timely information on trends and busses being used in the industry. The search turned up more than 33 busses. Twenty five of which were serial.

Research Potential Busses (ongoing) The minimum requirement for bus speed was considered to be an order of magnitude greater than the current standard. Eight serial busses with rates greater than 100 Mbps were identified (see table). These busses were selected for further review. The purpose of this stage is to reduce this number by more than half. The remaining busses will be studied in more detail.

Potential Serial Busses (> 100Mbps)	Rate (Mbps)
Heterogeneous Interconnect (HIC)	2000
FibreChannel	1000
Gigabit Ethernet	1000
Firewire	400
Serial Storage Architecture (SSA)	160
Synchronous Optical Network (SONET)	*155
Asynchronous Transfer Mode (ATM)	*155
Fiber Distributed Data Interface (FDDI)	125

*scalable with this rate the most common